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ABSTRACT

The study described in this paper utilized data from the National Assessment of Educational Progress (NAEP) to compare achievement trends among black and white students with respect to the variable of age at admission to first grade. The three age groups selected were nine, thirteen, and seventeen year olds. NAEP data in reading, mathematics, and science were combined and analyzed using multiple regression. Predictor variables included class age, relative age, sex, parental education, home environment, region, and type of community. It was found that by age seventeen, the differences between younger and older first grade entrants disappeared, but that trend differences persisted between white and black samples. It is argued that the change in whites is due in great part to higher retention rated among young males, and that for blacks there is a more general attrition phenomenon. (Author/GC)

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Age of admission and trends in achievement: A Comparison of Blacks and Whites

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Is there a best age for a child to enter the first grade? This difficult question has been the concern of parents, educators, administrators, and legislators for more than 50 yers. The actual criterion most consistently used by school districts for determining entrance into the first grade has been chronological age, with admission usually allowed at the beginning of the school year (Jones, 1968). Such a simple criterion has obvious administrative advantages, but also encourages pressure for change from parents and teachers. The result is frequent legislative reexamination of the laws governing entrance age requirements (Carline, 1968; Educational Research Service, 1975). But the consequences of school budget constraints and inadequate research have necessitated the continuation of the simple age requirement as the normal admission policy to first grade. However, the confusion and ambiguity with respect to these policies can be seen in the range of five calendar months found among the entrace age requirements for the nation's school districts (Educational Research Service, 1975; National Institute of Education, 1978).

Interestingly enough the research has followed several paradigms. One model has compared the oldest and youngest children within a given grade. For a majority of these studies, the "young" group consisted of students who entered first grade earlier than the legal chronological age. Hence, it is a young group consisting of special students being compared to normal older entrants. It is not surprising to find this young group showing equal or slightly superior academic performance (Hedges, 1977), but hardly generalizable to the

general population.

Indeed, when comparing the academic achievement of children entering school at the opposite ends of the normal twelve month entrance age period, almost all investigators found that the younger students received lower school grades and scored lower on achievement tests. The findings have been consistent, starting with Bigelow's early (1934) study, through King (1951), Green and Simmons (1962), Carrol (1963), and Hall (1963).

However, most of these studies have dealt with both restricted populations and grade ranges. One study did find an attenuation of these academic differences between normally entering older and younger children as they progressed through elementary school (Miller and Norris, 1967).

Our paper is based in part on a previous study (Kalk, Langer, & Searls, 1981) in which we traced a Caucasian-only sample through elementary, junior, and senior high school. Using National Assessment of Educational Progress (NAEP) data, we found that achievement differences between younger and older entering children attenuated with increasing time in the schools. The diminished achievement differential appeared to be partially a function of very high retention rates among young males. On the basis of these findings we decided to compare achievement trends among Blacks and Caucasians with respect to the age of admission variable.

The Coleman Report (1966), however controversial, clearly indicated that those educational variables contributing to success were not equally distributed among Blacks and Caucasians. Moreover, Stephan (1978) noted that of the assumptions underlying the 1954 Brown

decision (i.e. positive changes in attitudes, self-esteem, and achievement), only gains in achievement appear to be viable. Finally, previous NAEP data has suggested differing trends in achievement (NAEP, 1979).

METHOD

Sample Size and Grade Levels

This paper is based on national samples of 30,000 Caucasian (Kalk, et al, 1981) and 17,000 Black students. The three age groups selected were nine-, thirteen-, and seventeen-year olds, representing model grades of fourth, eighth, and eleventh. This permitted a trend analysis from elementary to high school. For a full description of the selection and other procedures, the reader is referred to our previous document. This is listed on your handout, and is available from NAEP.

Criterion Variable

NAEP data in reading, mathematics, and science were combined and analyzed using a regression analysis. Combining the data results in a more stable estimate of achievement. The criterion variable was defined as the ratio of correct exercises to attempted exercises (i.e. achievement scores) for each student. The scores were converted to percentiles. An inverse normal (probit) transformation (Statistical Analysis Systems Institute, 1979) was applied to create a symmetrical distribution, to meet the normality assumptions of the multiple regression analyses (Nie, et al, 1975). This provided a common basis for comparing different age groups.

Normal First Grade Entrance

For the creation of the samples used in this study, only those students who were progressing through school at the normal rate for

their school district were selected from the National Assessment sample. The primary basis for classifying a student as normal, advanced, or held back with respect to current grade level was a comparison of the student's birth month and the date by which a student had to be six years of age to be accepted into the first grade. A variety of data was examined to determine the cutoff date within each school district. Again, we must refer to the previous study for a full description of procedures.

Predictor Variables

The predictor variables included in this study were (a) class age, (b) relative age, (c) sex, (d) parental education, (e) home environment, (f) region, and (g) type of community. Chronological age was obtained directly from the birth month of each student, and was used to create two variables.

First was the relative age variable, derived from both the birthdate and the school district's cutoff date for entrance to first grade. This ordered students from oldest to youngest. Of course, whenever previous research had used students from a single district chronological and relative age were identical. In this national sample with differing cutoff dates relative age becomes a common scaling measure.

The second age variable was class age, based on the chronological age average of students in the classroom. The variable itself was dichotomized. An "old" category was derived, grouping students from states with September, October, and November cutoffs. The "young" group included states with December, January, or February cutoffs. This variable provided control over the potential confusion caused by

multiple cutoff dates (Kalk et al, 1981). Hence, we can examine relative age holding average class age constant.

Because of time, we shall once more refer the reader to our previous document for a full description of the other predictor variables (Kalk et al, 1981). It was necessary, however, to discuss the first two.

ANALYSIS

As mentioned previously, our data analyses are basically multiple regression procedures. Actually we used a stepwise regression analysis, entering class age and relative age first. These two were considered the most critical.

Combined Nine-Year-Old Samples

Table 1 summarizes the findings for the Caucasian sample (Kalk et al, 1981), while Table 2 presents the Black sample findings.

Insert Table 1 about here

Insert Table 2 about here

Looking at Table 1, the Caucasian sample, relative age ($F=30.9$, $p < .01$) and class age ($F=51.6$, $p < .01$) were statistically significant in the presence of the other ten variables (Kalk et al, 1981). Similarly for Blacks, relative age ($F=9.4$, $p < .01$) and class age ($F=7.6$, $p < .01$) were also significant.

The regression line for Caucasians has a significant negative slope which replicates findings from previous studies. The statistically significant negative beta weight (Column 1) of -.015 ($F=30.9$, $p < .01$) for relative age can be viewed as demonstrating an academic advantage for older students. For Blacks, the more negative beta weight of -.017 ($F=9.4$, $p < .01$) for relative age, indicates an even larger academic advantage for older students.

Independent of relative age, class age also contributes significantly to the prediction of achievement. In Table 1, for Caucasians, the positive beta weight (.069) for class age indicates that classrooms with an older mean age (i.e. September, October, November cutoff) have signifcantly ($F=51.6$, $p < .01$) superior performances when compared to classrooms with a younger mean age. Described another way, the class age variable measures the amount of achievement that can be explained by holding the relative age constant and measuring the chronological age of the student.

For Blacks the class age beta was also positive (.056) and statisically significant ($F=7.6$, $p < .01$). The two groups paralleled each other with the relative age and class age, with the slopes somewhat steeper for Blacks. There was no class age x relative age interaction for either group, a finding which held across all our analyses.

As noted previously prior research has indicated a higher retention rate among younger students, particularly males (Hedges, 1977). To examine this hypothesis, a held analysis consisting of a three way categorization of relative age, class age, and sex was created for students who should have been in the modal grade but who

had been retained one year. A multiple regression analysis was performed, using the proportion of retained students as the criterion variable (Kalk et al, 1981).

Figures 1 for Caucasians and Figure 2 for Blacks present our results graphically.

Insert Figure 1 about here

Insert Figure 2 about here

For Caucasians (Figure 1) the increasing proportions of retained students as relative age becomes younger has both a statistically significant linear trend ($F=10.6$, $p < .01$) and statistically significant quadratic component ($F=67.8$, $p < .01$). The quadratic component is the rather marked upswing at the end. Previous findings of a higher percentage of retained males was replicated with a statistically significant interaction between age and sex ($F=23.2$, $p < .01$). Table 1 shows that the proportion of retained males increases significantly faster than females as the student's relative age becomes younger. In fact, it is the youngest males in the "young" age group who are in the most danger (Kalk et al, 1981).

For Blacks, there is a statistically significant linear trend ($F=5.1$, $p < .01$) but no linear trend. Thus for Black students, Figure 2

shows a constant increase in the proportions retained as age decreases but not the sudden increase for Caucasians seen in Figure 1. The statistically significant sex effect (F=7.6, p <.01) replicates the Caucasian finding for higher percentages of males retained, but does not show the marked increase rate for males as relative age becomes younger. In short, there is no sex x relative age interaction.

Combined Thirteen-Year-Old Sample

Table 3 presents the regression data for Caucasians, while Table 4 presents the Black data.

Insert Table 3 about here

Insert Table 4 about here

For a Caucasian thirteen-year-old (Table 3) the regression line has a significant but flatter negative slope. The negative beta weight for relative age has decreased (-.007), but is still statistically significant. The class age variable while still positive is not significant, indicating that in the presence of the other predictors, the academic advantage found for the older nine-year-old group has disappeared (Kalk et al, 1981).

For Blacks the regression line is negative and somewhat steeper than for the Caucsian samples. We still find a statistically significant negative beta weight (-.015, F=7.5, p <.01) for relative age, which is only slightly less than that for Black nine-year-olds.

The class age beta of (.083) is actually higher than that for nine-year-olds (.056), and is statistically significant ($F=17.9$ $p < .01$).

Figures 3 and 4 give the held analyses.

Insert Figure 3 about here

Insert Figure 4 about here

In our held analysis (i.e. retained students), the pattern for the thirteen-year-olds in our Caucasian sample replicates that found for the nine-year-olds. Looking at Figure 3, there is both a statistically significant linear trend ($F=10.3$, $p < .01$) and quadratic trend ($F=58.5$, $p < .01$). There is also a statistically significant interaction between relative age and sex ($F=13.2$, $p < .01$), with the youngest males again in greatest danger (Kalk et al, 1981).

In Figure 4 we find for Black students a statistically significant linear trend ($F=6.1$, $p < .01$) and sex effect ($F=9.5$, $p < .01$). Again, there was no significant sex x relative age interaction, but there was a dramatic increase in the percentage of retained Black students.

This data needs some further clarification. For Caucasians we originally attributed the attenuation of achievement effect to such factors as (1) the high retention rate among young males, as well as (2) the acquisition of coping skills, and (3) remediation (Kalk et al, 1981). However, there are significant data differences for the Black

population, which might cause us to view our Caucasian assumptions differently. Let us turn to Table 5.

Insert Table 5 about here

For the Caucasian sample, there is an overall increase of 12.75% in the retention rate from age nine to age thirteen, with males increasing 14.26%, and females 10.71%. Among Blacks there is an overall increase of 40.26%, with males increasing 36.61% and females 46.72%. In short, for Blacks there is less of a relative age effect, and more of a general attrition including a marked increase among females.

The Black data phenomenon is not amenable to simplistic explanations. For example, additional held analyses indicated that among Blacks, males are particularly in greatest jepoardy as a function of region (the Southeast), and community-type (low metro-rural). For Caucasians, parental education is critical. We can also presume that for the surviving Blacks (and we use the term in its fullest meaning) many of the same factors present in our Caucasian sample are also operative here.

Combined Seventeen-Year-Old Sample

The regression data for seventeen year-olds is found in Tables 6 and 7.

Insert Table 6 about here

Insert Table 7 about here

For the Caucasian sample, as seen in Table 6, neither relative age (.002) or class age (.001) are significant in the presence of the other predictors. Table 7 presents the data for our Black sample. We again find that relative age (B=.011) and class age (B= -.041) are both non-significant. For both groups, the regression line has a flat slope not significantly different from zero.

The held analyses for seventeen-year-olds are not included in your handout, but breifly there are no significant changes in proportions for either group, and the patterns hold from age 13. By seventeen, the age phenomenon has pretty well vanished.

DISCUSSION

We cannot, in the time remaining, present any extended discussion of our data. As noted, by age 17 the differences between young and old have disappeared, but there are trend differences between the Caucasian and Black samples. For Caucasians, we have argued that the change is due in great part to higher retention rates among young males; for Blacks it is a more general attrition phenomenon.

In our previous paper dealing with the Caucasian-only sample (Kalk et al, 1981), we suggested clinical screening for several groups: (1) for districts with December, January, or February cutoffs, the highest risk groups include males in the youngest half of the clan, or females in the youngest quarter, (2) for districts with September, October, and November cutoffs, the highest risk group includes males in the youngest third of the class. Signs of inadequate readiness pose potentially serious threats to the child's

academic career and suggests delaying entrance until the following year.

We would even more strongly urge similar procedures for entering Black students, and recommend more intensive intervention/remediation procedures in the early grade.

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TABLE 1

Summary of Multiple Regression for Age Nine Caucasians Combined for the Mathematics, Science and Reading Assessments

Variable	B	F	p	R Square	Adj. R Sq.	Simple r	Over-all F	p
Relative Age	-.015	30.9	.01	.002		-.048	20.4	.01
Class Age	.069	51.6	.01	.003	.003	.013	20.4	.01
Home Environment Low	-.264	163.6	.01	.047	.047	-.211	230.0	.01
Parental Education Low	-.242	137.7	.01	.077	.077	-.211	291.2	.01
Type of Community High	.237	90.5	.01	.089	.088	.122	269.9	.01
Home Environment High	.206	120.0	.01	.097	.097	.201	249.5	.01
Southeast	-.159	59.2	.01	.103	.102	-.094	227.1	.01
Parental Education High	.156	56.1	.01	.106	.106	.199	206.9	.01
Type of Community Low	-.118	23.0	.01	.108	.107	-.075	187.0	.01
Northeast	.086	16.7	.01	.109	.108	.073	170.1	.01
Sex	-.004	.2	ns	.109	.108	.017	154.7	.01

TABLE 2

Summary of Multiple Regression for Age Nine Blacks Combined for the Mathematics, Science and Reading Assessments

Variable	B	F	p	R Square	Adj. R Sq.	Simple r	Over-all F	p
Relative Age	-.017	9.4	.01	.003		-.059	6.0	.01
Class Age	.056	7.6	.01	.004	.003	.006	6.0	.01
Home Environment Low	-.184	20.6	.01	.032	.031	-.171	33.9	.01
Type of Community High	.441	27.6	.01	.050	.048	.142	39.7	.01
Parental Education Low	-.160	13.9	.01	.062	.061	-.144	40.4	.01
Southeast	-.148	13.2	.01	.069	.068	-.093	37.8	.01
Type of Community Low	-.183	22.1	.01	.075	.073	-.100	35.4	.01
Home Environment High	.177	13.5	.01	.080	.077	.157	33.0	.01
Northeast	.159	9.5	.01	.083	.080	.096	30.5	.01
Sex	-.045	6.6	.01	.085	.082	-.034	28.1	.01
Parental Education High	.120	6.4	.01	.087	.083	.133	26.2	.01

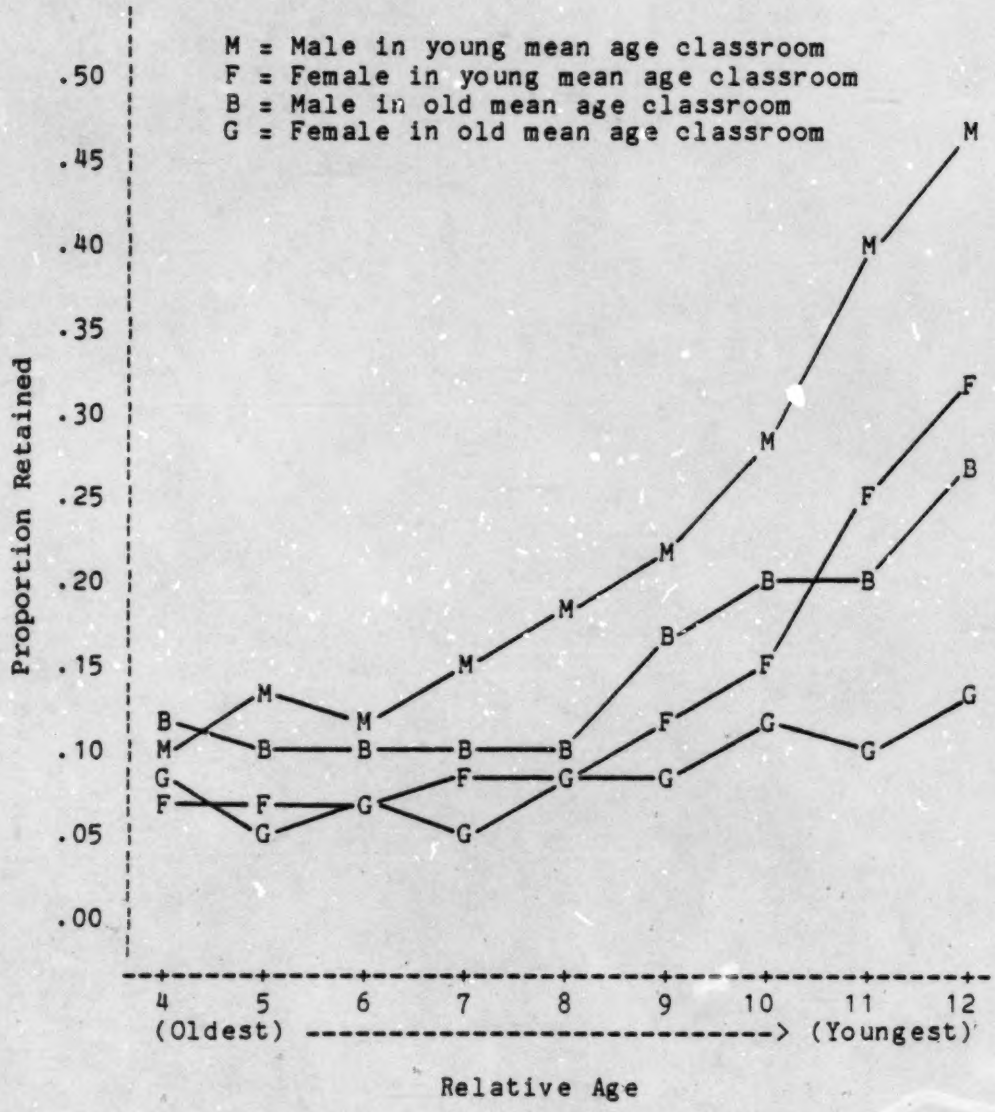

Figure 1: Proportion of Caucasian Nine-Year-Olds Who Belong in Fourth Grade But Have Been Retained One Grade Categorized by the Relative Age, Class Age and Sex Variables

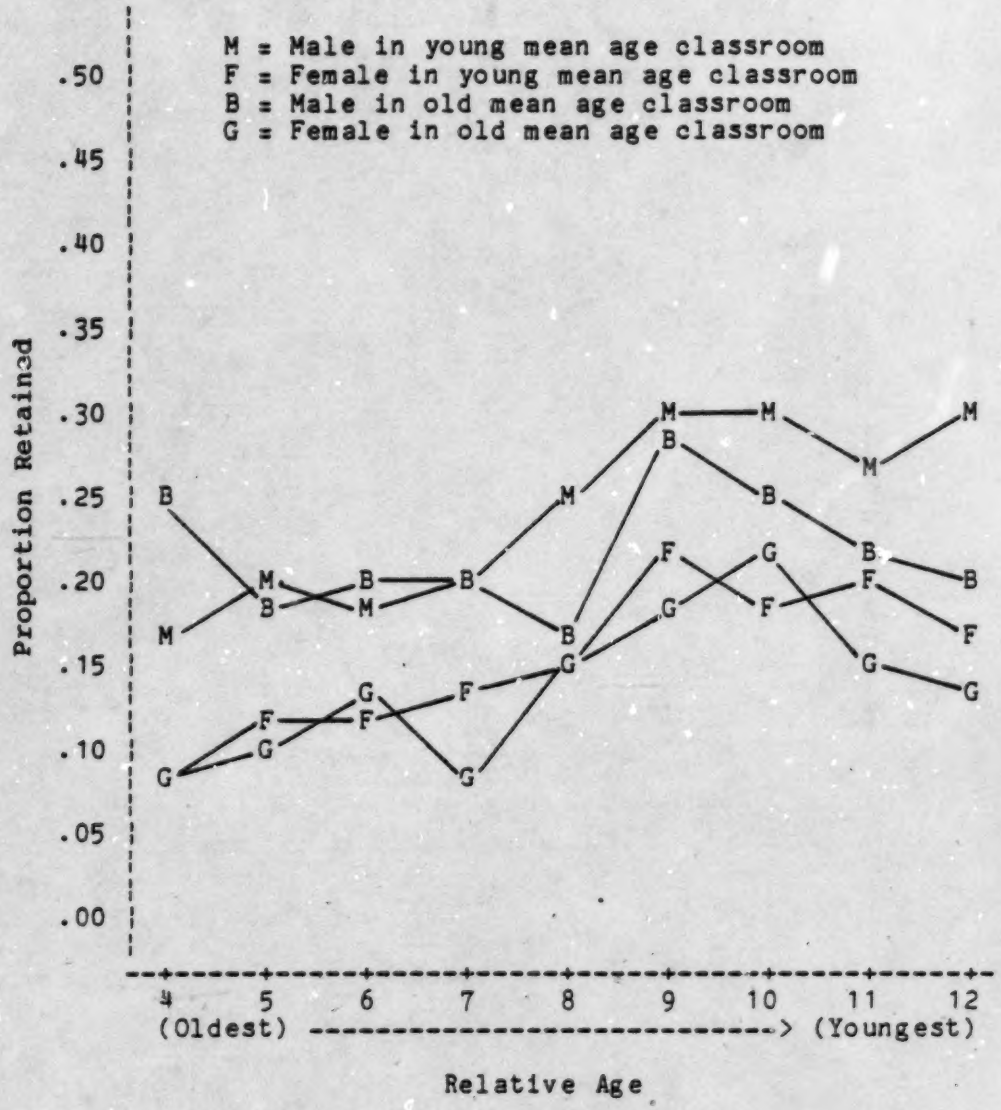

Figure 2: Proportion of Black Nine-Year-Olds Who Belong in Fourth Grade But Have Been Retained One Grade Categorized by the Relative Age, Class Age and Sex Variables

TABLE 3

Summary of Multiple Regression for Age Thirteen Caucasians Combined for the Mathematics, Science and Reading Assessments

Variable	B	F	p	R Square	Adj. R Sq.	Simple r	Over-all F	p
Relative Age	-.007	6.8	.01	.001		-.026	8.7	.01
Class Age	.014	2.5	ns	.001	.001	-.025	8.7	.01
Parental Education High	.338	398.4	.01	.069	.069	.261	393.8	.01
Home Environment High	.234	177.5	.01	.094	.094	.212	413.5	.01
Parental Education Low	-.233	113.9	.01	.102	.102	-.213	363.6	.01
Southeast	-.152	59.8	.01	.108	.108	-.097	322.1	.01
Home Environment Low	-.233	76.1	.01	.113	.112	-.163	289.2	.01
Type of Community High	.164	51.2	.01	.116	.115	.155	261.2	.01
Type of Community Low	-.104	19.5	.01	.117	.117	-.076	234.9	.01
Sex	.023	9.4	.01	.118	.117	.034	212.5	.01
Northeast	.055	7.8	.01	.119	.117	.052	194.0	.01

TABLE 4

Summary of Multiple Regression for Age Thirteen Blacks Combined for the Mathematics, Science and Reading Assessments

Variable	B	F	p	R Square	Adj. R Sq.	Simple r	Over-all F	p
Relative Age	-.015	7.5	.01	.003		-.055	4.7	.01
Class Age	.083	17.9	.01	.003	.002	-.014	4.7	.01
Home Environment High	.243	37.0	.01	.060	.059	.239	65.4	.01
Northeast	.323	43.0	.01	.091	.090	.191	77.1	.01
Parental Education High	.220	28.0	.01	.113	.112	.199	78.9	.01
Type of Community Low	-.239	41.2	.01	.125	.124	-.135	73.6	.01
Home Environment Low	-.199	21.4	.01	.133	.131	-.219	67.4	.01
Southeast	-.153	13.9	.01	.138	.135	-.171	61.4	.01
Parental Education Low	-.146	13.1	.01	.141	.139	-.191	56.2	.01
Type of Community High	.263	8.8	.01	.143	.141	.102	51.6	.01
Sex	-.019	1.3	ns	.144	.141	-.014	47.0	.01

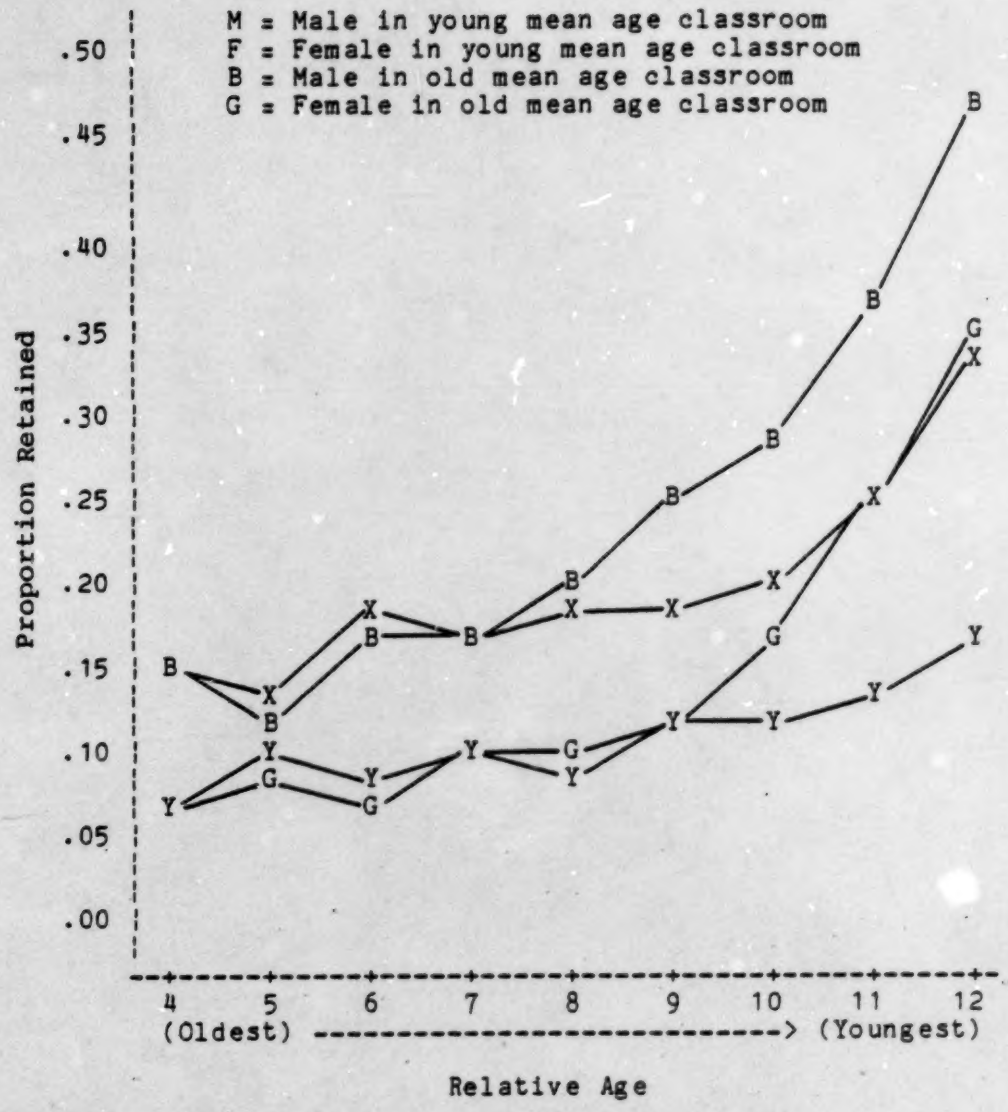

Figure 3: Proportion of Caucasian Thirteen-Year-Olds Who Belong in Fourth Grade But Have Been Retained One Grade Categorized by the Relative Age, Class Age and Sex Variables

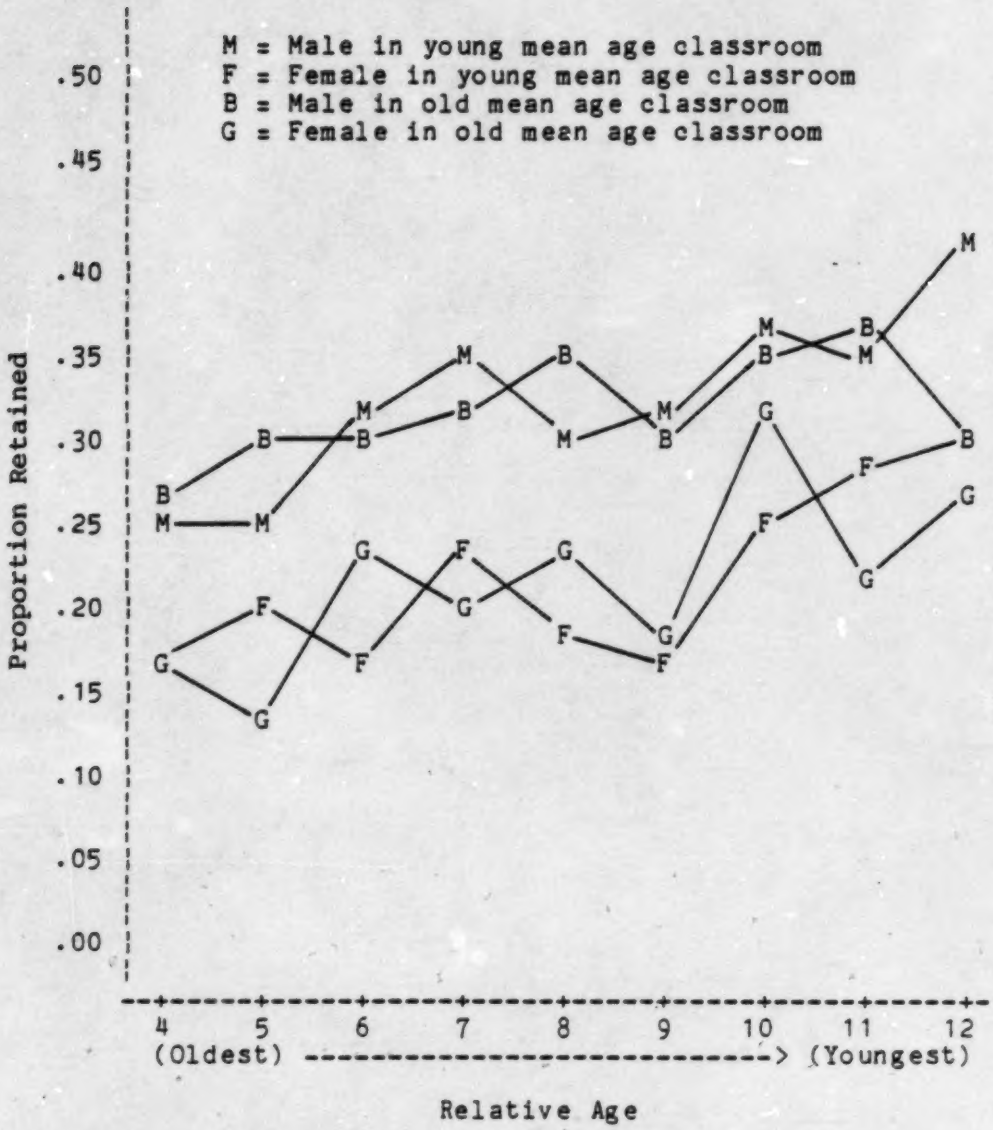

Figure 4: Proportion of Black Thirteen-Year-Olds Who Belong in Eighth Grade But Have Been Retained One Grade Categorized by the Relative Age, Class Age and Sex Variables

TABLE 5

Proportion of Caucasian and Black Students for the Nine-Year-Old and Thirteen-Year-Old Populations Who Belong in the Modal Grade But Have Been Retained One Grade

Sex	Population					
	Caucasian			Black		
	9	13	Percent Increase	9	13	Percent Increase
Male	.1844	.2107	14.26	.2300	.3142	36.61
Female	.1083	.1199	10.71	.1447	.2123	46.72
Total	.1467	.1654	12.75	.1853	.2599	40.26

TABLE 6

Summary of Multiple Regression for Age Seventeen Caucasians Combined for the Mathematics, Science and Reading Assessments

Variable	B	F	p	R Square	Adj. R Sq.	Simple r	Over-all F	p
Relative Age	.002	.7	ns	.000		.002	9.0	.01
Class Age	.001	.0	ns	.001	.001	-.031	9.0	.01
Parental Education High	.342	461.8	.01	.058	.058	.239	355.1	.01
Home Environment High	.202	124.6	.01	.075	.075	.173	354.4	.01
Sex	.091	158.3	.01	.084	.084	.098	318.3	.01
Parental Education Low	-.213	82.7	.01	.089	.089	-.177	283.0	.01
Type of Community High	.168	49.7	.01	.092	.092	.092	252.0	.01
Home Environment Low	-.200	52.6	.01	.095	.095	-.139	228.0	.01
Northeast	.101	26.5	.01	.097	.097	.064	207.9	.01
Southeast	-.110	30.0	.01	.099	.098	-.067	190.1	.01
Type of Community Low	-.102	22.5	.01	.100	.099	-.067	175.1	.01

TABLE 7

Summary of Multiple Regression for Age Seventeen Blacks Combined for the Mathematics, Science and Reading Assessments

Variable	B	F	p	R Square	Adj. R Sq.	Simple r	Over-all F	p
Relative Age	.011	3.1	ns	.001		.034	6.8	.01
Class Age	-.041	3.3	ns	.006	.005	-.060	6.8	.01
Parental Education High	.278	33.0	.01	.042	.041	.197	35.4	.01
Home Environment High	.168	13.0	.01	.062	.061	.179	39.9	.01
Type of Community Low	-.198	22.0	.01	.071	.069	-.101	36.8	.01
Home Environment Low	-.195	13.9	.01	.077	.075	-.163	33.4	.01
Southeast	-.081	3.1	ns	.081	.078	-.085	30.0	.01
Sex	-.055	7.6	.01	.084	.081	.044	27.3	.01
Type of Community High	.219	4.8	.01	.086	.082	.086	24.9	.01
Parental Education Low	-.106	4.9	.01	.088	.084	-.154	23.0	.01
Northeast	.105	3.1	ns	.089	.085	.089	21.2	.01